

WHAT IS CLAIMED IS:

## 1. An alternating current motor comprising:

a rotor configured to rotate about a longitudinal axis, the rotor comprising a diametrically magnetized permanent magnet;

stationary coils having a magnetic axis substantially perpendicular to the rotor's longitudinal axis, the stationary coils adapted to the rotor's outer periphery and being substantially coaxial with the rotor's longitudinal axis;

a stator adapted to the stationary coils' outer periphery and being substantially coaxial with the rotor's longitudinal axis; and

wherein the diametrically magnetized permanent magnet is configured to cause the rotor's oscillation angle to vary substantially less than 30% between the rotor's oscillation angle at a beginning value of a frequency range of an alternating current in the stationary coil and the rotor's oscillation angle at an ending value of the frequency range of the alternating current in the stationary coils.

2. The motor of claim 1, wherein the diametrically magnetized permanent magnet is configured to cause the rotor's oscillation angle to vary substantially less than 20% between the rotor's oscillation angle at the beginning value of the frequency range of the alternating current in the stationary coils and the rotor's oscillation angle at the ending value of the frequency range of the alternating current in the stationary coil.

FINNEGAN  
HENDERSON  
FARABOW  
GARRETT &  
DUNNER LLP

1300 I Street, NW  
Washington, DC 20005  
202.408.4000  
Fax 202.408.4400  
www.finnegan.com

3. The motor of claim 1, wherein the diametrically magnetized permanent magnet is configured to cause the rotor's oscillation angle to vary substantially less than 10% between the rotor's oscillation angle at the beginning value of the frequency range of the alternating current in the stationary coils and the rotor's oscillation angle at the ending value of the frequency range of the alternating current in the stationary coils.

4. The motor of claim 1, wherein the frequency range is 40 Hz.

5. The motor of claim 1, wherein the diametrically magnetized permanent magnet is configured to cause the rotor's oscillation angle to vary substantially less than 30% over a frequency range of an alternating current in the stationary coils regardless of a magnitude of a load on the rotor.

6. The motor of claim 1, wherein the diametrically magnetized permanent magnet comprises at least one of a rare earth material, NdFeB, Samarium Cobalt, and Neodymium.

7. The motor of claim 1, wherein the diametrically magnetized permanent magnet comprises one or more segments symmetrical about the longitudinal axis.

8. The motor of claim 7, wherein at least one of the one or more segments comprises two pieces.

9. The motor of claim 8, wherein one of the two pieces comprises a north pole and another the two pieces comprises a south pole.

10. The motor of claim 8, wherein the two pieces are substantial equal by at least one of volume and weight.

11. The motor of claim 1, wherein the stator has a substantially constant permeability for all rotor angular positions about the longitudinal axis.

12. The motor of claim 1, wherein the stator is substantially cylindrical.

13. The motor of claim 1, wherein the stator comprises soft iron.

14. The motor of claim 1, wherein the stator comprises at least two pieces.

15. The motor of claim 1, wherein the alternating current motor is disposed with in one of a small handheld appliance, a beauty care device, a sexual simulation device, a tooth brush, a body massage device, a shoes polisher, a jewelry care device, a hair trimming device, and a hair shaving device.

16. The motor of claim 1, further comprising a recall spring configured to cause the rotor to oscillate at a certain angle.

FINNEGAN  
HENDERSON  
FARABOW  
GARRETT &  
DUNNER LLP

1300 I Street, NW  
Washington, DC 20005  
202.408.4000  
Fax 202.408.4400  
www.finnegan.com

17. The motor of claim 1, further comprising a control switch configured to control the amount of electrical power delivered to the motor inside a casing, the control switch comprising a permanent magnet located outside the casing configured to control a plurality of reed switches located inside the casing, the reed switches supplying electrical current to a system of resistors.

18. The motor of claim 1, wherein the diametrically magnetized permanent magnet comprises a plurality of diametrically magnetized segments arranged in parallel along the longitudinal axis, wherein each segment is symmetrically oriented about the longitudinal axis, and wherein the number of diametrically magnetized segments included in the motor depends upon a required power output of the motor.

19. An alternating current oscillating motor comprising:

a rotor configured to rotate about a longitudinal axis, the rotor comprising a diametrically magnetized permanent magnet having at least one of a remanence of at least 10KG, a coercive force of at least 10KOe, an intrinsic coercive force of at least 12 KOe, and a maximum energy product of at least 30 MGOe;

stationary coils having a magnetic axis substantially perpendicular to the rotor's longitudinal axis, the stationary coils adapted to the rotor's outer periphery and being substantially coaxial with the rotor's longitudinal axis; and

a stator adapted to the stationary coils' outer periphery and being substantially coaxial with the rotor's longitudinal axis, the stator having a substantially constant permeability for all rotor angular positions about the longitudinal axis.

20. The motor of claim 19, wherein the diametrically magnetized permanent magnet comprises at least one of a rare earth material, NdFeB, Samarium Cobalt, and Neodymium.

21. The motor of claim 19, wherein the diametrically magnetized permanent magnet comprises one or more segments symmetrical about the longitudinal axis.

22. The motor of claim 21, wherein at least one of the one or more segments comprises two pieces.

FINNEGAN  
HENDERSON  
FARABOW  
GARRETT &  
DUNNER LLP

1300 I Street, NW  
Washington, DC 20005  
202.408.4000  
Fax 202.408.4400  
www.finnegan.com

23. The motor of claim 22, wherein one of the two pieces comprises a north pole and another the two pieces comprises a south pole.

24. The motor of claim 22, wherein the two pieces are substantial equal by at least one of volume and weight.

25. The motor of claim 19, wherein the stator is substantially cylindrical.

26. The motor of claim 19, wherein the stator comprises soft iron.

27. The motor of claim 19, wherein the stator comprises at least two pieces.

28. The motor of claim 19, wherein the alternating current oscillating motor is disposed with in one of a small handheld appliance, a beauty care device, a sexual simulation device, a tooth brush, a body massage device, a shoes polisher, a jewelry care device, a hair trimming device, and a hair shaving device.

29. The motor of claim 19, further comprising a recall spring configured to cause the rotor to oscillate at a certain angle.

30. The motor of claim 19, further comprising a control switch configured to control the amount of electrical power delivered to the motor inside a casing, the control switch comprising a permanent magnet located outside the casing configured to control

a plurality of reed switches located inside the casing, the reed switches supplying electrical current to a system of resistors.

31. The motor of claim 19, wherein the diametrically magnetized permanent magnet comprises a plurality of diametrically magnetized segments arranged in parallel along the longitudinal axis, wherein each segment is symmetrically oriented about the longitudinal axis, and wherein the number of diametrically magnetized segments included in the motor depends upon a required power output of the motor.